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II. Election/Restriction Requirement

The Office alleges that restriction is required between the following claims under 35 U.S.C. §§ 121 and 372:

Group I: Claims 1-25 drawn to a method for identifying impurities in a cryogenic liquid.

Group II: Claims 25-29 drawn to a system for sampling a plurality of cryogenic liquid samples.

Applicants hereby affirm the election of Claims 1-25 without traverse. The election is made without traverse because Applicants agree that Claims 1-25 are patentably distinct from Claims 26-29. Claims 26-29 have been canceled without prejudice or disclaimer thereto.

III. Specification

The specification is objected to as not written in such clear and exact terms as to enable any routineer in the art to practice the invention in its best mode.

Firstly, the Office acknowledges measuring the absorption spectrum of the cryogenic liquid using IR spectroscopy and obtaining the reference cryogenic liquid absorption spectrum. The Office alleges that it is not clear what is meant by the expression that this spectrum has "a first reference energy". The Office indicates that the IR spectrum cannot have energy – it contains absorption signals at certain wavelengths, which, the Office maintains, correspond to certain energies. The Office indicates that the same is true for the "same reference energy". Although Applicants believe that these terms enable one to practice the invention, amendments to the

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specification have been made, per the suggestion of the Office. Additionally, Applicants maintain that the Office must accept that the disclosure is enabling in accordance with controlling case law, in that the Office offers nothing to indicate that the specification lacks enablement other than conjecture.

"The only relevant concern of the Patent Office under these circumstances should be over the truth over any such assertion. The first paragraph of § 112 requires nothing more than objective enablement. How such a teaching is set forth, either by the use of illustrative examples or by broad terminology, is of no importance.

As a matter of Patent Office practice, then, a specification disclosure which contains a teaching of the manner and process of making and using the invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented *must* be taken as in compliance with the enabling requirement of the first paragraph of § 112 *unless* there is reason to doubt the objective truth of the statements contained therein which must be relied on for enabling support."

In re Marzocchi & Horton, 169 USPQ 367, at 369 (CCPA 1971)

Secondly, the Office alleges that it is even less clear how these absorption energies can be divided over one another and what can be the result of such division. The Office states that this is equivalent to dividing one wavelength over another which "does not make much sense". Absent the subjective assertions of the Examiner, the Office provides absolutely no objective support for the above position.

Applicants respectfully disagree with the Office. In particular, Applicants maintain that resulting division does have meaning as set forth by the teachings of the specification. In accordance with long-standing case law set forth in *In re Marzocchi & Horton* referenced above, the Office must accept the teachings of Applicant's specification as being objectively enabled. In the matter at hand, on page 6, line 23 through page 7, line 2, Applicants clearly teach that absorption energies are proportionate to the amount of molecules present. Accordingly, a mathematical operation involving such energies can

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be used in determining amount of component or contaminant present. As mandated by controlling case law set forth by *In re Marzocchi & Horton*, such objective teachings must be accepted for their veracity. The Office offers nothing objective to question such teachings.

Thirdly, the Office further alleges that it is not conventional practice in the art to define chemical compounds, i.e., contaminants or impurities, by their vibration energies in Hz as shown on page 6 of the specification. Although Applicants do not agree with the Office, such values have been amended to express those energies in wavelength values. Such values have been obtained by employing the following equation:

$$\text{wavelength} = \text{speed of light}/\text{frequency}$$

It is submitted that no new matter is introduced by way of such amendment.

IV. 35 U.S.C. § 112

Claims 8, 10-25 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. The Office alleges that the claim(s) contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is mostly nearly connected, to make and/or use the invention. In particular, the Office alleges that the specification does not adequately explain what the first and second reference energies of the absorption spectra are, and how it is possible to measure the concentration of the impurity in the sample by using the ratio of these two "reference energies".

Applicants respectfully submit that this issue has been addressed in the above section pertaining to the specification. Nonetheless, to further

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clarify this issue, Applicants have amended Claims 8 and 10 to recited "first reference absorption energy" and "second reference absorption energy".

The Office alleges that Claims 8, 16 and 24 recite compounds defined by their vibration frequencies in Hz, which, according to the Office, is not a conventional way for defining compounds. Although Applicants believe these claims to be fully enabled, such have been amended per the Office's comments for the purpose of expediting prosecution.

Claims 1-25 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point and distinctly claim the subject matter regarded as the invention. The Office alleges that the expression "3 x 10e14 – 12e14 Hz" is not clear.

Although Applicants disagree with the Office, this expression has been amended in the specification and claims. As is well known in the art, $3 \times 10e14$ corresponds to 3×10^{14} . Moreover, $12e14$ corresponds to 12×10^{14} or 1.2×10^{15} . Applying the equation set forth on the preceding page:

$$3 \times 10^{14} \text{ Hz} \sim 1000 \text{ nm}$$

$$1.2 \times 10^{15} \text{ Hz} \sim 250 \text{ nm}$$

It is submitted that no new matter is introduced by way of such amendment.

V. 35 U.S.C. § 102

Claims 1-5, 7 and 9 are rejected under 35 U.S.C. § 102(b) as being anticipated by Moulson et al. "Monitoring of Dopant and Impurity Concentrations in Liquid Argon by Infrared Spectroscopy", *Nuclear Instruments & Methods in Physics Res., Section A: Accelerators*,

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Spectrometers, Detectors, and Associated Equipment (1992), A320(1-2), 277-2 ("Moulson"). The Office alleges:

"Moulson teaches 'monitoring of dopant and impurity concentrations in liquid argon by infrared spectroscopy' (Title) by measuring IR spectra of cryogenic argon (Figure 2), an impurity (volatile organic compound having CH bond, ethylene) alone (Figure 3a) and impurity in the cryogenic liquid (Figure 3b) in a spectrum range 400-4000 cm⁻¹ (2500-250 nm) (Figures 1-3) in a flow cell with a pressure drop between 0.85-1.05 bar (~lb/in²) (page 278, right column) and confirming the presence of the impurity by comparing the spectrum with the reference spectra of pure argon and ethylene"

Applicants respectfully traverse each and every aspect of this rejection.

It is respectfully submitted that Moulson does not anticipate the present invention. "For a prior art reference to anticipate in terms of 35 U.S.C. § 102, every element of the claimed invention must be identically shown in a single reference". *In re Bond*, 15 USPQ2d 1566, 1567 (Fed. Cir. 1990) citing *Diversitech Corp. v. Centure Steps, Inc.* 7 USPQ2d 1315, 1317 (Fed. Cir. 1988). As discussed in detail hereinbelow, Moulson does not identically disclose every recited element of the claims in question. Accordingly, Moulson does not anticipate such claims in accordance with 35 U.S.C. § 102.

Applicants' invention is fundamentally distinct from the disclosure of Moulson. As set forth in the Applicants' specification, and as recited by the claims in question, Applicants' invention relates to a method for identifying impurities in a cryogenic liquid in which the steps of the method are carried out such that the sampling and analysis of the impurity(s) is carried out in an on-line fashion. Claims 1, 10 and 18 have been amended to better reflect this feature. Support for this amendment can be found on page 9, lines 12-14 of the specification.

The disclosure of Moulson is contrary to Applicants' claimed invention. Moulson teaches a technique for monitoring dopant which is not considered

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an on-line process, but is instead batch. To illustrate this point, the Office is directed to pp. 277-278 of Moulson, which discloses the employed experimental set-up. In particular, the passage states that:

"A Bruker IFS-66 FT-IR spectrometer with a spectral resolution of 0.25 cm^{-1} was used to collect the spectra. The IR beam was obtained from a medium-infrared Globar source and received by an external, liquid nitrogen-cooled-mercury-cadmium-telluride detector. Spectra were collected and analyzed using OPUS/IR version 1.2 software [6].

Samples were analyzed in a cryogenic cell with volume of 1.00 l. The cell was originally designed to be combined with a detector used to study the ionization characteristics and electron mobilities of doped liquid argon solutions [7], so that IR analysis of the solutions could be performed *in situ*. For the present studies, however, the cell was detached from the detector, surrounded by 25 layers of aluminized Mylar and mounted inside a vacuum cryostat of its own."

(emphasis added)

As is evident from the above passage, the detector is operated separately and in detached fashion from the cell, i.e., Moulson does not disclose an on-line system continuous sampling and analysis of a component in clear contrast to the present invention. Moulson instead discloses single cell analysis distinguishable from an on-line analysis.

Since Moulson clearly does not disclose all features of the invention as defined by Claims 1-5, 7 and 9, such claims are not anticipated by Moulson. A withdrawal of this rejection under 35 U.S.C. § 102(b) is therefore respectfully solicited.

VI. 35 U.S.C. § 103

Claim 6 is rejected as being unpatentable over Moulson. The Office alleges:

"While Moulson does not specifically teach fluorinated hydrocarbons as cryogenic liquids, it would have been obvious for anyone of ordinary

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skill in the art to apply his method to analyze purification of such compounds, because various applications of e.g., freons require their purification, and Moulson's method is obviously the most convenient for determining their purity."

Applicants respectfully traverse each and every aspect of this rejection.

As argued above, Claim 1 is patentable over Moulson. It is submitted that Claim 6 which depends from Claim 1, is also patentable over Moulson. Claim 6 cannot be viewed as obvious in view of the teachings of Moulson since Moulson does not disclose or suggest using an on-line system. Accordingly, Claim 6 is unobvious in view of Moulson. A withdrawal of this rejection under 35 U.S.C. § 103(a) is therefore respectfully solicited.

VII. Conclusion

The points of the Office Action being addressed in full, a Notice of Allowability is respectfully requested.

Respectfully submitted,

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